Message

From: GeneConvene Virtual Institute [contact@geneconvenevi.org]
Sent: 9/7/2021 5:07:50 AM
To: Kirk, Cassandra [kirk.cassandra@epa.gov]
Subject: Female meiotic drive - REVIEWED; Transgenic mosquitoes and malaria - REVIEWED; Wolbachia evolution in Aedes aegypti in Australia examimed

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09/07/2021

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GENE CONVENE GLOBAL COLLABORATIVE Virtual Institute

Sharing knowledge to facilitate understanding of gene drive and other genetic biocontrol technologies

Gene Drive & Genetic Biocontrol Newsletter

September 07, 2021

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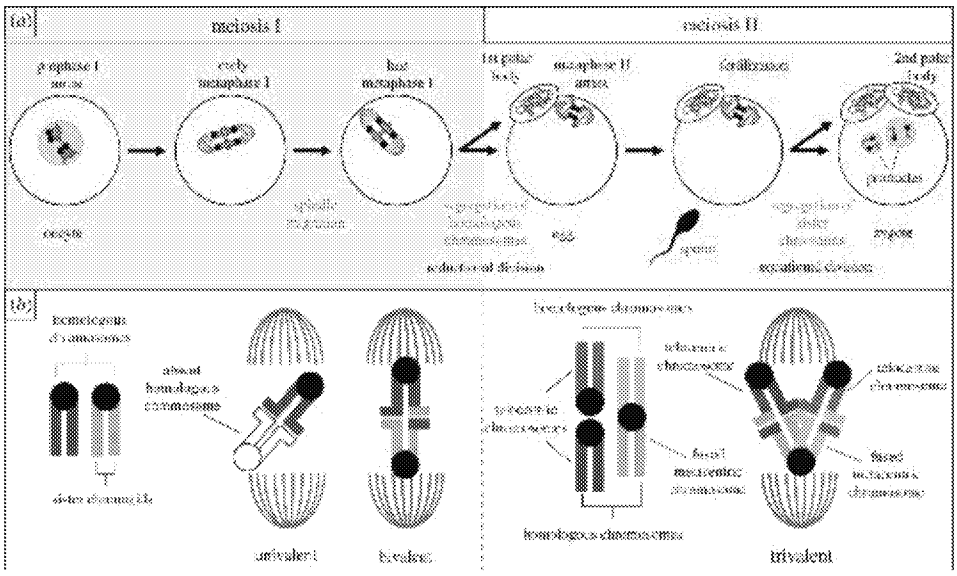
Genetic biocontrol, also known as genetic pest management and genetic control, is an active research space. Here we have aggregated research and media reports that have appeared since the previous Newsletter.

New Research and Scholarship

Gene Drive: Natural

9/2/2021 Unravelling the mystery of female meiotic drive: where we are
Clark, F. E. and Akera, T.
Open Biol
https://doi.org/10.1098/rsob.210074
Female meiotic drive is the phenomenon where a selfish genetic element alters chromosome segregation during female meiosis to segregate to the egg and transmit to the next generation more frequently than Mendelian expectation. While several examples of female meiotic drive have been known for many decades, a molecular understanding of the underlying mechanisms has been elusive. Recent advances in this area in several model species prompts a comparative re-examination of these drive systems. In this review, we compare female meiotic drive of several animal and plant species, highlighting pertinent similarities.



8/26/2021 Parallel pathways for recruiting effector proteins determine centromere drive and suppression

Kumon, T., Ma, J., Akins, R. B., Stefanik, D., Nordgren, C. E., Kim, J., et al.

Cell

https://doi.org/10.1016/j.cell.2021.07.037

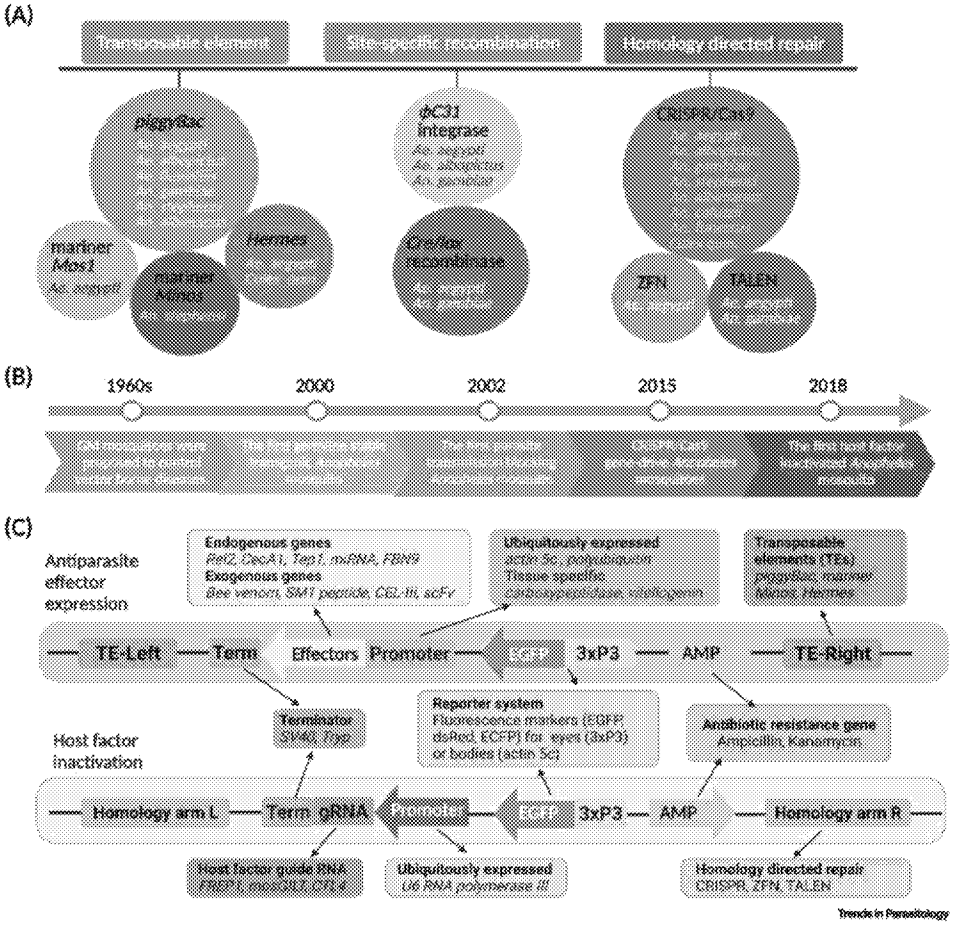
Selfish centromere DNA sequences bias their transmission to the egg in female meiosis. Evolutionary theory suggests that centromere proteins evolve to suppress costs of this centromere drive. In hybrid mouse models with genetically different maternal and paternal centromeres, selfish centromere DNA exploits a kinetochore pathway to recruit microtubule-destabilizing proteins that act as drive effectors. We show that such functional differences are suppressed by a parallel pathway for effector recruitment by heterochromatin, which is similar between centromeres in this system. Disrupting the kinetochore pathway with a divergent allele of CENP-C reduces functional differences between centromeres, whereas disrupting heterochromatin by CENP-B deletion amplifies the differences. Molecular evolution analyses using Murinae genomes identify adaptive evolution in proteins in both pathways. We propose that centromere proteins have recurrently evolved to minimize the kinetochore pathway, which is exploited by selfish DNA, relative to the heterochromatin pathway that equalizes centromeres, while maintaining essential functions.

Gene Drive: Engineered

9/2/2021 Mosquito transgenesis for malaria control

Dong, S., Dong, Y., Simões, M. L. and Dimopoulos, G.

Trends in Parasitology
https://doi.org/10.1016/j.pt.2021.08.001
Malaria is one of the deadliest diseases. Because of the ineffectiveness of current malaria-control methods, several novel mosquito vector-based control strategies have been proposed to supplement existing control strategies. Mosquito transgenesis and gene drive have emerged as promising tools for preventing the spread of malaria by either suppressing mosquito populations by self-destructing mosquitoes or replacing mosquito populations with disease-refractory populations. Here we review the development of mosquito transgenesis and its application for malaria control, highlighting the transgenic expression of antiparasitic effector genes, inactivation of host factor genes, and manipulation of miRNAs and lncRNAs. Overall, from a malaria-control perspective, mosquito transgenesis is not envisioned as a stand-alone approach; rather, its use is proposed as a complement to existing vector-control strategies.



8/31/2021 Gene drive escape from resistance depends on mechanism and ecology
Cook, F., Bull, J. J. and Gomulkiewicz, R.
bioRxiv
https://doi.org/10.1101/2021.08.30.458221
Gene drives can potentially be used to suppress pest populations, and the advent of CRISPR technology has made it feasible to engineer them in many species, especially insects. What remains largely unknown for implementations is whether anti-drive resistance will evolve to block the population suppression. An especially serious threat to some kinds of drive

is mutations in the CRISPR cleavage sequence that block the action of CRISPR, but designs have been proposed to avoid this type of resistance. Various types of resistance at loci away from the cleavage site remain a possibility, which is the focus here. It is known that modest-effect suppression drives can essentially `outrun' unlinked resistance even when that resistance is present from the start. We demonstrate here how the risk of evolving (unlinked) resistance can be further reduced without compromising overall suppression by introducing multiple suppression drives or by designing drives with specific ecological effects. However, we show that even modest-effect suppression drives remain vulnerable to the evolution of extreme levels of inbreeding, which halt the spread of the drive without actually interfering with its mechanism. The landscape of resistance evolution against suppression drives is therefore .....

Genetic Biocontrol

8/17/2021

Genetically Modified Mosquitoes
Caragata, E. P., Lee, Y. and Buckner, E. A.
EDIS
https://doi.org/10.32473/edis-in1326-2021
Genetically modified (GM) mosquitoes are controversial, partly because of misinformation. This publication provides science-based information about GM mosquitoes to the public and anyone involved in mosquito control. It explains what GM mosquitoes are and why they are being investigated as a tool for mosquito control. Describes a GM mosquito pilot project in Florida, and includes FAQs and answers explaining how GM mosquitoes are created and their potential impacts on people and the environment.

Wolbachia

9/2/2021

wMel Wolbachia genome remains stable after 7 years in Australian Aedes aegypti field populations
Dainty, K. R., Hawkey, J., Judd, L. M., Pacidônio, E. C., Duyvestyn, J. M., Gonçalves, D. S., et al.
Microb Genom
https://doi.org/10.1099/mgen.0.000641
Infection of wMel Wolbachia in Aedes aegypti imparts two signature features that enable its application for biocontrol of dengue. First, the

susceptibility of mosquitoes to viruses such as dengue and Zika is reduced. Second, a reproductive manipulation is caused that enables wMel introgression into wild-type mosquito populations. The long-term success of this method relies, in part, on evolution of the wMel genome not compromising the critical features that make it an attractive biocontrol tool. This study compared the wMel Wolbachia genome at the time of initial releases and 1-7 years post-release in Cairns, Australia. Our results show the wMel genome remains highly conserved up to 7 years post-release in gene sequence, content, synteny and structure. This work suggests the wMel genome is stable in its new mosquito host and, therefore, provides reassurance on the potential for wMel to deliver long-term public-health impacts.

More Research and Scholarship in the Virtual Institute

Genetic Biocontrol in Africa

African Genetic Biocontrol Consortium

Build | Inform | Expand

The Consortium was officially launched on 30th November 2020 by inaugural not-for- profit member organizations based in Africa. The member organizations included the Africa One Health Network (AfOHNet), Africa Biological Safety Association (AfBSA), The Multilateral Initiative on Malaria (MIM), Network of African Science Academies (NASAC), Pan-African Mosquito Control Association (PAMCA) and the GeneConvene Global Collaborative (GeneConvene).

The main objective for establishment of the Consortium is to provide a platform for interaction among African experts and institutions to enhance opportunities for technical capacity strengthening, knowledge exchange and deliberation about the challenges and

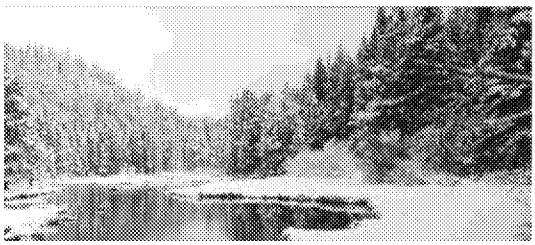
opportunities of genetic biocontrol technologies for the public good, which will strengthen African influence on their development and provide critical input for decision-making by product developers, policy makers, and other stakeholders.

Learn More about AGBC

Conferences in 2022

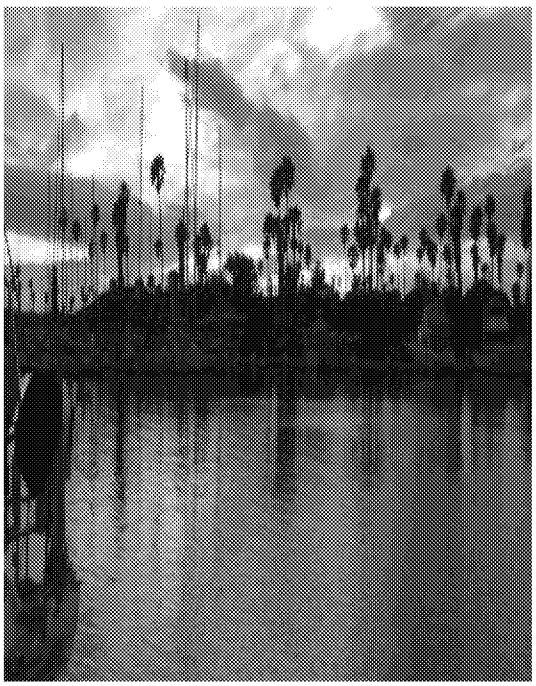
Gene Drives and Selfish Genetic Elements

- Presented by: **Keystone Symposia**
- Scientific Organizers: David A. O'Brochta, Fred Gould, Amanda Larracuente and Owain Edwards
- Date: January 23 - 26, 2022
- Location: Granlibakken Tahoe, Tahoe City, CA, USA
- Abstract Deadline: October 14 2021



Genetic Biocontrol: New Biological Platforms for Affecting Phenotype Changes for Control

- Presented by: **Gordon Research Conferences**
- Scientific Organizers: Alfred Handler and David O'Brochta
- Date: June 26-July 1, 2022
- Location: Four Points Sheraton / Holiday Inn ExpressVentura, CA, US



New Media Coverage

9/20/2019 Gene Drive Mosquitoes: Ethics, Environment and Efficacy
Wilburn, L.
ScienceInnovationUnion
https://science-union.org/articlelist/2019/9/20/gene-drive-mosquitoes-ethics-environment-and-efficacy
The Bill and Melinda Gates foundation has recently donated over $75 million to fund gene drive mosquito research by Target Malaria , a consortium that aims to develop technology for malaria control. The first planned release of gene drive mosquitoes .....

9/2/2021 Genetically Modified Mosquitoes — What's The Real Story?
SPW Staff
Southeast Product Weekly
https://southeastproduceweekly.com/2021/09/02/genetically-modified-mosquitoes-whats-the-real-story/
You've heard about the genetically modified mutant mosquitoes being released in the Florida Keys — but what exactly is going on, and how, and why? Basically, researchers in parts of the Florida Keys are releasing male mosquitoes that have been .....

9/1/2021 EPA Seeks Public Comment on Proposed Amendment to Experimental Use Permit for Genetically Engineered Mosquitoes

PCT Staff
Pest Control Technology
https://www.pctonline.com/article/epa-public-comment-genetically-modified-mosquitoes/
EPA is seeking public comment on a proposed amendment to extend and expand an approved Experimental Use Permit (EUP). The EUP currently allows Oxitec Ltd. to field test the use of genetically engineered Aedes aegypti mosquitoes as a way to .....

9/1/2021

UF/IFAS Researchers Explain Science Behind Genetically Modified Mosquitoes
PCT Staff
Pest Control Technology
https://www.pctonline.com/article/uf-researchers-explain-science-behind-genetically-modified-mosquitoes/
South Florida residents seeking science-based information about genetically modified mosquitoes can access a new, online resource from University of Florida scientists at the UF/IFAS Florida Medical Entomology Laboratory.“ Genetically Modified Mosquitoes” is the latest publication on Ask IFAS, UF/IFAS’ .....

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